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AUTHOR Brunken, Phyllis
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ABSTRACT

Visually handicapped students (10-19 years old) at the Nebraska School for the Visually Handicapped receive training on computer equipment for word processing, computer literacy, programming, and computer assisted instruction. Hardware and software used in the program include the Kurzweil Reading Machine, the VersaBraille system, Total Talk, and Braille-Edit. Eight levels of utilization are being developed: tutorial, computer literacy, prevocational education, personal use application, programming, career planning, word processing, and administration. Among the criteria affecting success in the computer technology program are knowledge of the keyboard and development of listening skills. Student case studies illustrate the program's success. Components of the program are outlined, equipment used in the program is listed, and the names and addresses of resources are provided. (SW)

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Phyllis Brunken
Computer Instructor and Media Specialist
Nebraska School for the Visually Handicapped
P. O. Box 129
Nebraska City, NE 68410
(402-873-5513)

INDEPENDENCE FOR THE VISUALLY HANDICAPPED THROUGH TECHNOLOGY

The Declaration of Indpendence signed on July 4, 1776, was the result of a revolution. It freed the colonists from the rule of the English King. It started an experiment in freedom which is over 207 years old. We are experiencing a technology revolution that will lead to greater independence for the visually handicapped. This revolution is not unlike the colonial revolution. It is welcomed with open arms by some or awaited in sheer terror by others. Whatever our reaction, the technology revolution is upon us.

The impact of the technology revolution is quite evident at the Nebraska School for the Visually Handicapped. The school and staff have made a commitment to making this technology available to the students at the school. Nearly four years ago, an Apple computer was borrowed from the Educational Service Unit for six weeks for use in a mini-course in computer literacy. From that meager beginning, the computer lab has grown to include three Apple Computers with two disk drives each, the Total Talk Computer Terminal, three Echo II Synthetic Voice systems, two VersaBraille systems, the IDS 460G Printer, the Apple Letter Quality Printer, the Cranmer Modified Perkins Brailler, two Optacons and the Kurzweil Reading Machine. The students receiving training range in age from 10 to 19; many having other handicapping conditions in addition to visual impairments. Students receive training on the various pieces of equipment and then utilize them for word processing, computer literacy, programming and computer assisted instruction. Visually handicapped adults have also visited the program to evaluate how computer technology will increase their job skills. Staff development ranging from computer literacy to high levels of expertise has been achieved. The program has served as one of the field study sites for the Vanderbilt University research project entitled "Research on Multimedia Access to Microcomputers for the Visually Impaired Youth".

EC162863

HARDWARE AND SOFTWARE

The Kurzweil Reading Machine (KRM) uses a small computer-controlled camera to scan print and translate it into synthetic speech. It has been called the most important single advancement in reading for the blind since the development of braille. The Xerox Corporation underwrote a grant to place 200 KRM's throughout the United States. The Nebraska School for the Visually Handicapped was selected as a site due to the commitment by the school and the staff in the utilization of electronic technology by the visually handicapped person.

Through the Federal Dissemination Program, two Optacons are available for training purposes. Training time required to develop a high skill level varies greatly. Conversion of optical impulses to moving tactile stimuli represents the first major breakthrough in the application of electronic technology for visually handicapped persons. Rapidly changing technology is replacing some of the Optacon's applications with improved and less expensive equipment.

There is a high degree of transfer of skills in usage among the various electronic aids. With as little as two hours of instruction, a student can access print materials. Thus, if the KRM is a tool the student can utilize, it is the first piece of equipment that the student learns to use. The student experiences immediate feedback to a new learned skill through accessing (reading) printed materials previously inaccessible. The skill of understanding synthetic voice output is readily transferred to other synthetic voice output equipment such as Total Talk and Echo II. Learning to use the KRM keyboard provides a basis for learning to control the cursor on the visual display. The movement of the KRM scanner corresponds to the movement of the cursor across the visual display for a computer. The success that a student experiences with KRM provides additional motivation to learn to use other electronic aids.

The VersaBraille system manufactured by Telesensory Systems is a self-contained braille and audio information center emphasizing logical storage and easy retrieval of braille on cassette tape. This system is portable, simple to operate, and can be adapted to a wide variety of applications. Electronic braille provides a new freedom for the braille user. Braille can be edited through overwriting, inserting and deleting. The ability to change braille text without the tedium of rewriting the entire page is a phenomenon foreign to the braille user. This is a skill that must be learned along with learning how to use the VersaBraille System.

VersaBraille is interfacable with the Apple computer via a California Computer Systems (CCS) card or the Apple Super Serial card. The system then serves as a braille terminal capable of input and output to the host computer.

Total Talk is a well-equipped computer terminal that talks. Its many features meet the demands of both the computer professional and the non-technical user, for example, a student user. The visually handicapped operator listens to all transmitted information; a page, a selected line or a single word. Total Talk is interfaced with an Apple II Microcomputer but is capable of interfacing with minicomputers and mainframes. Voice quality and cursor control are exceptional features of Total Talk. The function key control of the cursor correlates with the keyboard control of the KRM scanner. This facilitates the transfer of training between the two electronic devices. Voice output of lines, words or characters are readily available to the user. Total Talk paved the way for Maryland Computer Services ITS--Information Thru Speech computer system. ITS is a synthetic speech computer and terminal.

Braille-Edit, Applewriter, Word Handler II, and Bank Street Writer are four word processing programs used by the students and staff to produce various written documents. Braille-Edit is a word processing program that can be used by the visually handicapped person. The user can access the system via the computer keyboard, electronic braille systems, visual display and synthetic voice. Braille-Edit provides access to formatting information such as capitalization, carriage returns and centering. The visually handicapped user can independently produce letter-perfect documents. Bank Street Writer is a very user-friendly program. Low vision students can use this program with the appropriate visual display. This program can be used with a wide range of learning abilities. The only way to fail with this system is to turn off the computer without saving the file. Applewriter was used by some of the students but requires a higher cognitive level of development by the student for proper utilization. It is more abstract in that the visual display shows only upper case letters with upper case denoted by highlighted letters. Knowledge of many control characters is required for proper employment of the program. Word Handler II is preferred by some staff members for its formatting versatility.

TRAINING

Students receive training on the various electronic equipment dependent upon their needs. The Vanderbilt modules are used to provide training in basic equipment components and accessing techniques. These modules are easy to follow and to use in student instruction. The Optacon, VersaBraille and Kurzweil materials are used to provide training on those specific pieces of equipment. The manuals that are provided with the other equipment are good technical manuals but do not serve as training manuals. Training on the Apple computers is designed by the instructor.

UTILIZATION

At the school eight levels of utilization are being developed:

1. Tutorial -- Provide repetitive instruction on subjects such as math, spelling, social studies, science and language arts.
2. Computer Literacy -- Study computers and how they effect our lives.
3. Pre-vocational -- Learn skills necessary for occupations that involve computer technology.
4. Personal Use Application -- Apply skills learned to broaden educational and vocational opportunities.
5. Programming -- Understand the logical development of instructions executed by the computer.
6. Career Planning -- Access to career exploration materials.
7. Word Processing -- Write, edit, and print documents.
8. Administrative -- Maintain address files, inventories, student records, IEP's, and report forms.

The Echo Speech Synthesizer available from Street Electronics is a valuable enhancement to many computer functions ranging from educational programs to games to working with the handicapped to business applications. A Texas Instruments chip produces remarkably intelligible speech at a low cost. An easy to install circuit board and speaker comprise the system. While the speaker has good sound quality and the volume can be adjusted, voice output can be distracting in the classroom or office setting. This problem can be circumvented by the addition of a multiple jackbox and headphones. This arrangement allows for use of the speaker, student headphones and teacher headphones as the situation requires.

A computerized version of the popular Perkins Brailler is the Cranmer Modified Perkins Brailler or Perky. It is a braille computer terminal and a low-cost braille printer. It can be used to produce hard copy braille documents composed on the host computer or electronic braille system.

Two Apple II Plus 3.3 Microcomputers and Apple //e serve as the backbone for the program. All three computers are the standard models interfaced with the VersaBraille, the Echo, the Total Talk, and the Cranmer Modified Perkins Brailler. The RESET key has been set to work with the CTRL key to prevent any accidental resets. A few students prefer to have the "f" and "j" keys marked with small felt dots to denote homerow position.

Two green phosphorus monitors, an early Apollo monitor and a nineteen-inch color television are employed as video displays by students with usable vision. Each video display unit has its own particular advantages and must be matched with the student's visual needs. The green phosphorus monitors are preferred by the light-sensitive and some low vision students. Studies have shown that the green phosphorus monitors result in the least eye strain. Low vision students who are benefitted by magnification prefer the Apollo monitor and the 19" color television. These produce a larger image than the green phosphorus monitors. The color television provides the unique feature of color-tinted text. Two students expressed a definite preference for a yellow-blue tint to the characters displayed.

Software includes word processing programs, programming tutorials, spelling programs, reading comprehension and tutorials and educational games for many other subject content areas. Educational materials produced by Minnesota Educational Computing Consortium (MECC), Sterling Swift and Educational Activities are accessed by the students. Career exploration information is available on diskette from the Nebraska Career Information System (NCIS). PFS File maintains address files. Computerized IEP Software is being evaulated for adoption by the school.

Synthetic voice and braille access to software is limited to programs which are specifically designed for that purpose or those that are not write-protected or locked. The program must be executed with the RUN command in order for it to be accessible.

Tutorial -- Thus far, improvement of spelling skills has been the main utilization of the tutorial capabilities of the computer. Three software programs have been employed: Spelltronics (Educational Activities), Spelling Test (MECC) and Spelling Test (Echo II). The Spelling Test provided on the Textalker Diskette that comes with the Echo II is a good program. It does not test visual memory by flashing the word on the screen. Instead, it says the word. This program is a valuable tool for any student. The program uses teacher-made spelling lists. These programs provide repetitive spelling practice with positive reinforcement.

Computer literacy, Pre-vocational and Personal Use Application -- These three levels of utilization overlap in the instruction and training curriculum. Both the student population and staff are receiving instruction on these topics. At least seventy percent of all jobs in the 1990's will employ computer technology. The course materials are selected from the many resources available. No single source has proved completely satisfactory.

Programming -- Courses in the BASIC language are available for those students who have demonstrated the cognitive skills necessary. Results of the PAVE evaluation materials are used to determine the appropriate level of instruction. The Module 3 of the Vanderbilt project provides a basis for instruction. A selection of programming materials has proved useful in the instruction of these courses.

Career Planning -- Students can explore career opportunities by way of the computerized version of the Nebraska Career Information System. Localized versions of this system are available in at least thirteen other states. This system is accessible through visual display and synthetic voice.

Word Processing -- This level of utilization is receiving the most emphasis in the program. Student grades have improved by at least ten percent just through the application of word processing for written assignments. While composing, the student is freed of the constraints of proper grammatical structure, spelling and formatting. Creativity is encouraged because the student can freely add and delete text. Corrections and changes can be made in a matter of minutes and an error-free document can be produced. If the instructor recommends any changes, these can be made and a new document produced without the wearisome task of retyping it which could result in other errors. Word processing promotes proofreading because the changes are so easy to make. The teachers are requesting that students be trained in word processing because of the improvement in the quality of the student's work.

Administrative -- Word processing is also being utilized by the staff to generate written documents such as letters, reports, articles, skill sheets and report cards. The feasibility of computerized IEP's is being studied. Address files are maintained on PFS File. The library staff generates catalog cards using the Catalog Card & Label Writer. Plans are being made to maintain a directory of the educational media.

ENTRY LEVEL SKILLS

Progress and success in the computer technology program is affected by the following criteria:

1. Knowledge of the keyboard
2. Development of listening skills
3. Ability to follow directions
4. Level of cognitive development
5. Level of English literacy in print or braille
6. Basic components of a microcomputer system

Though many users of computers use the "hunt and peck method" to input information, this is not a productive method for low vision or blind persons to use. Thus, knowledge of the keyboard is an essential entry level skill. The formats learned in typing also assist the student in understanding the visual display and aids in learning the word processing programs.

Learning to understand synthetic speech and process the information is contingent on good listening skills. The user has access to large amounts of information, not only what is being read, but how it is spelled, capitalized, punctuated and formatted.

One of the major elements of good study skills is the ability to follow directions and this is an important skill in accessing computers. The user must be able to follow directions to operate the equipment, understand how it works, program it to perform various functions, and follow instructions generated by the computer.

The level of cognitive development has to be considered when determining the instructional approach to employ. Results of the PAVE Test, which is based on Piaget's Theories of Cognitive Development, can serve as a guideline as to level of development.

Literacy in reading and writing, whether in print or braille, must also be considered when planning the instructional program. For example, it is difficult to rationalize the training of locating a paragraph on the VersaBraille when the student does not know what a paragraph is or why he would want to find a paragraph. This is not to say that through the use of technology the student will not improve his level of literacy but the approach and skills taught must be carefully developed. This is well illustrated by the students learning word processing. The same spelling and mechanical errors are made, however, the student can correct them.

CASE STUDIES

Jeff was injured in a motorcycle accident causing blindness and loss of tactile sensation in his fingers except for the outer portion of each thumb. He was limited to using auditory materials. Often he would use three tape recorders to do his homework. He did learn to type, however, he had difficulty controlling his fingers and often held down the key on the electric typewriter too long and got multiple keystrokes. Jeff learned to use the Total Talk. After only twenty minutes of hearing the multiple keystrokes, he learned to control his fingers. Using Braille-Edit, Jeff typed, proofread, corrected and printed his own class assignments. Instead of writing a one-page book report, he would write five-page book reports. He wrote a letter home to his parents. When they received it, they immediately called him and asked how he had gotten it perfect. Jeff is now attending college and has purchased his own computer system.

Diane was one of the first students involved in the computer program. She took computer literacy and programming. Diane did not like programming. After many frustrating classroom hours, she was allowed to dropout. Later she started seeing the improved grades her fellow students were receiving because of word processing so she came back to the computer lab. She quickly learned word processing and successfully applied it to her classwork.

The English teacher was skeptical of the computer equipment being purchased by the school until Mark completed the best research paper he had ever written. He accomplished this task in under two weeks. At that point, the English teacher stated, "Show me the computers." Mark also studied advanced BASIC programming and Pascal. He now is in college enrolled in computer science.

Six students participated in the Vanderbilt Project with all but one completing the first two modules. These modules serve as a basic guide in the instruction of computer literacy and access technology.

Students learning to use the VersaBraille are amazed that the instructor can actually see the braille on the visual display as the student is reading and writing. This promotes increased accuracy in braille skills.

The students who received instruction and training have also contributed to the program by being willing, patient, and highly-motivated subjects in this experimental computer lab for visually handicapped users.

TIMING

When and where to begin was a question our school faced. If we had not begun when we did, three graduates would not be utilizing computer technology and experiencing the freedom it provides. Our students would not be experiencing the success of generating improved written documents. They would not be learning computer literacy which they will need in the world ahead.

FREEDOM

Technology is removing some of the barriers for the visually handicapped. It will help those of us who are dedicated to the philosophy that an education should help the student walk away from us--from dependency to independency. Access technology will provide the freedom to work when you want to work not when someone is available to work with you. Freedom to use print media. Freedom to produce perfect documents independent of a reader. Freedom to choose from an ever-broadening range of careers.

FUTURE

Future needs include training teachers, evaluation and adaptation of hardware and software, and sharing information among persons utilizing computer technology. Access to write-protected programs is essential so that more materials are available for the visually handicapped user.

The talking calculators are a good example of the future of technology uses for the visually handicapped. Eight years ago Telesensory Systems, Inc., produced the Speech+ Calculator for $500. Now, talking calculators are available from Sharp and Panasonic for $50 to $100. All the electronic equipment will not take such dramatic price drops. As the technology is paid for by the consumers, advancements in miniaturization and broader use of technology is made, the price will decrease and become more readily available for an individual. As synthetic voice applications are made for the general consumer, more materials will become available for the visually handicapped user.

The students at the Nebraska School for the Visually Handicapped will be prepared to take full advantage of the developing technology.

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4. Level of cognitive development
5. Level of English literacy in print or braille
6. Basic component of a microcomputer system

FINANCES

A. Costs

1. Total value of hardware - $70,069
2. Value of software, media and supplies - $3,000
3. Service contracts per year - Total $4,000

B. Sources of Funding

1. Matching Vocational Education Grants for 1980-81 and 1981-82
2. Nebraska School for the Visually Handicapped Trust Fund
3. Xerox Grant/Kurzweil
4. Federal Grant for Dissemination of Optacons
5. General Fund Budget Items

NEBRASKA SCHOOL FOR THE VISUALLY HANDICAPPED

EQUIPMENT LIST

1. Three Apple 3.3 microcomputers

   a. Apple II Plus 3.3 equipped with two disk drives, 16K RAM card, asynchronous serial card for interfacing with Total Talk Terminal, Apollo CCTV Monitor, Echo Synthetic Voice System, Cranmer Modified Perkins Brailler interfaced with an Apple Super Serial card, and Kensington System Saver

   b. Apple II Plus 3.3 equipped with two disk drives, 16K RAM card, IDS 460G dot matrix printer with parallel card, 19" color television, Echo Synthetic Voice System, 13" green phosphorus monitor, and Kensington System Saver

   c. Apple //e 3.3 equipped with two disk drives, Apple letter quality printer, Echo Synthetic Voice System, VersaBraille P2C using a CCS 7701.02 interface card

2. Three Echo Synthetic Voice Systems modified with jackbox and headphones

3. Total Talk Synthetic Speech Terminal interfaced with asynchronous serial card

4. Two Optacons and visual display

5. IDS460G Paper Tiger Printer interfaced with parallel card

6. Apple Letter Quality Printer interfaced with Apple Super Serial card

7. Two VersaBraille Systems

   a. VersaBraille P1

   b. VersaBraille P2C interfaced with CCS 7701.02 interface card, cable and adaptor from Raised Dot Computing

8. Kurzweil Reading Machine Model III with KRM #2300 Software Program

9. Cranmer Modified Perkins Brailler (Perky) interfaced with Apple Super Serial card

10. Three monitors

   a. Zenith 13" green phosphorus

   b. RCA XL-100 19" color television

   c. Apple /// monitor

   d. Apollo CCTV monitor

RESOURCES

Apple Products
Contact local Apple dealer

Dr. Sam Ashcroft, Principal Investigator
Department of Special Education
George Peabody College of Vanderbilt University
P. O. Box 328
Nashville, Tenn. 37203
615-322-8165
Modules I, II, III plus diskette are available for $12.50

California Computer Systems
250 Caribbean Drive M/28
Sunnyvale, CA 94086
CCS 7710.02 Interface card

Carroll Center for the Blind
770 Centre Street
Newton, MA 02158
Aids and Appliances Review

Maryland Computer Service
2010 Rock Spring Road
Forest Hill, Maryland 21050
301-879-3366
Total Talk, ITS, Cranmer Modified Perkins Brailler--Perky

Microsoft
400 108th Avenue. NE Suite 500
Bellevue, WA 98004
Typing Tutor

Dr. Mary Moore
Dept. of Special Education
University of Pittsburg
M25 Forbes Quad
Pittsburg, PA 15260
412-624-1411
VersaBraille Application for Blind Secondary and College Students

Raised-Dot Computing
David Holladay
310 South 7th Street
Lewisburg, PA 17837
717-523-6739
Braille-Edit, newsletter and hardware

Scholastic Book Services
900 Sylvan Avenue
Englewood Cliffs, NJ 07632
Bank Street Writer and Bank Street Speller

Silicon Valley Systems, Inc.
1625 EL Camino Real #4
Belmont, CA 94002
Word Handler II

Sterling Swift Publishing Company
1600 Fortview Road
Austin, Texas 78704
512-444-7570
Computer Literacy Show and Tell Kit

Street Electronics Corporation
1140 Mark Avenue
Carpinteria, California 93013
805-684-4593
Echo II

Telesensory Systems, Inc.
455 North Bernardo Avenue
P. O. Box 7455
Mountain View, California 94043-5274
415-960-0920

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